

# Restoration of Halstead Meadow Sequoia National Park, CA



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# Sierra Meadows

- <1% of landscape
- Support high plant + animal biodiversity, productivity, amphibians, small mammals, birds
- Many highly disturbed by 1800's livestock grazing, road construction



# “Meadow”

Common use in US : non-forested  
ecosystem within forested landscape

*Trees are generally absent due to long  
duration saturation ...*



- Gully 4-12 feet deep, lowered water table in meadow
- Vegetation change, surface water forms channel
- Widening and eroding soils
- Pocket gopher, vole, mole invasion disturbs soils



Enclosed  
livestock  
denuded  
meadow,  
erosion and  
then road  
with culverts





- Two vegetation types
- Two hydrologic systems





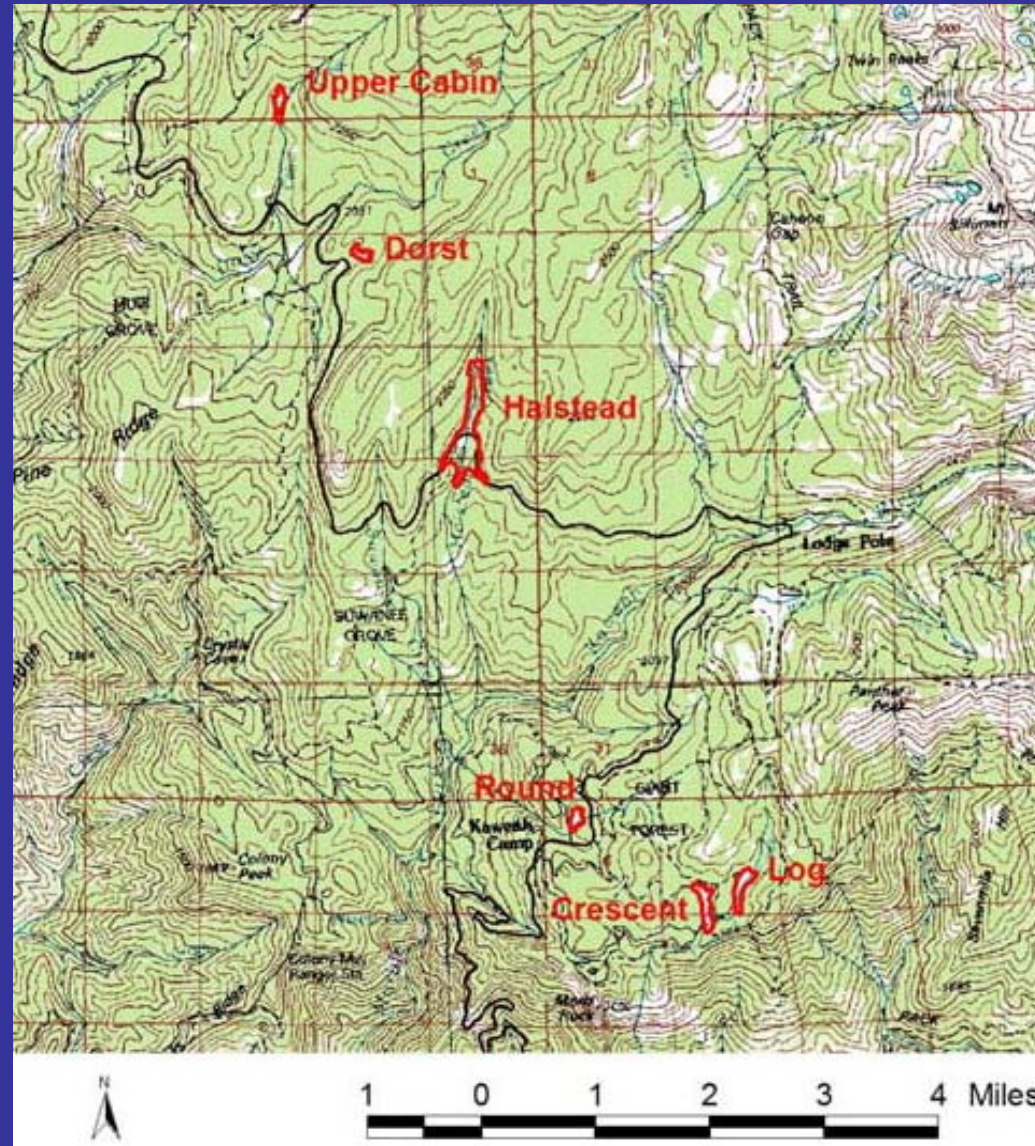




# To develop reference concepts

## Investigate 6 natural meadows in SEKI

1. Presence of stream channels
2. Topography
3. Water table depth in summer
4. Function of large wood, treefalls
5. Natural vegetation









Round Meadow

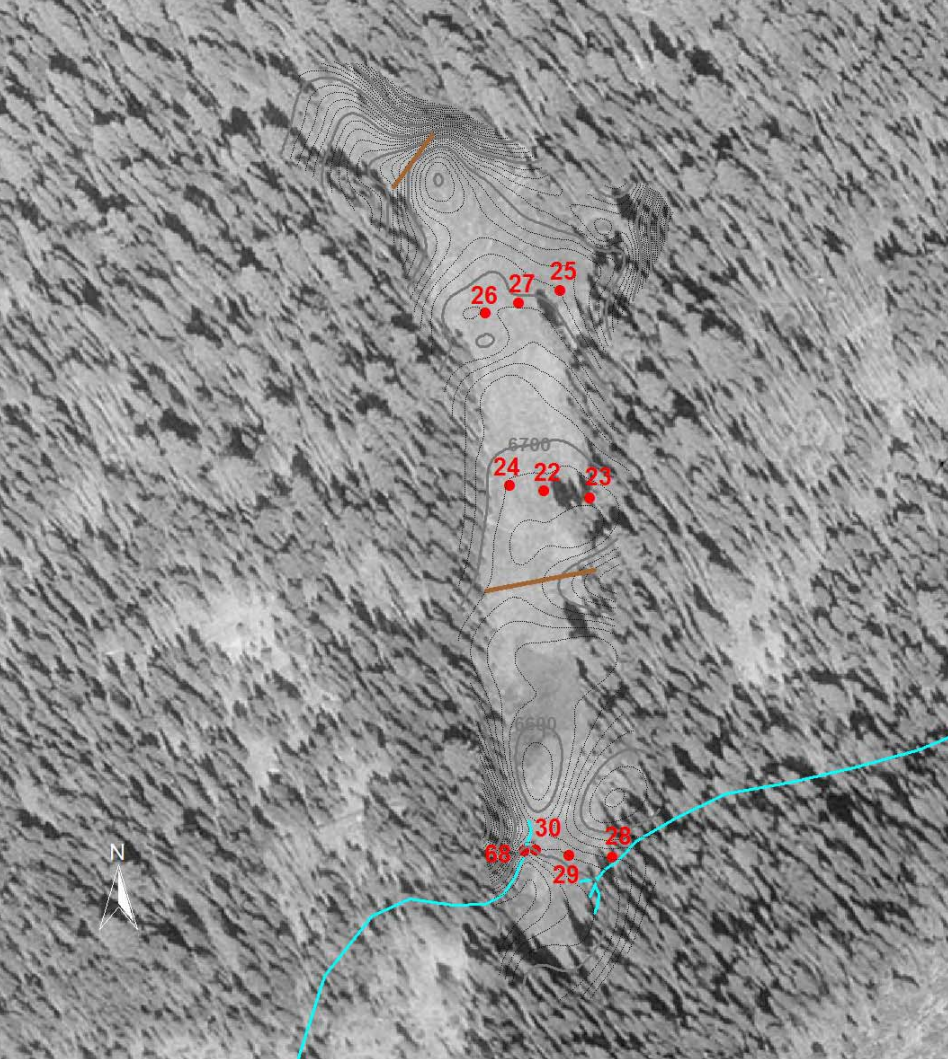




Natural meadows are level  
in cross section



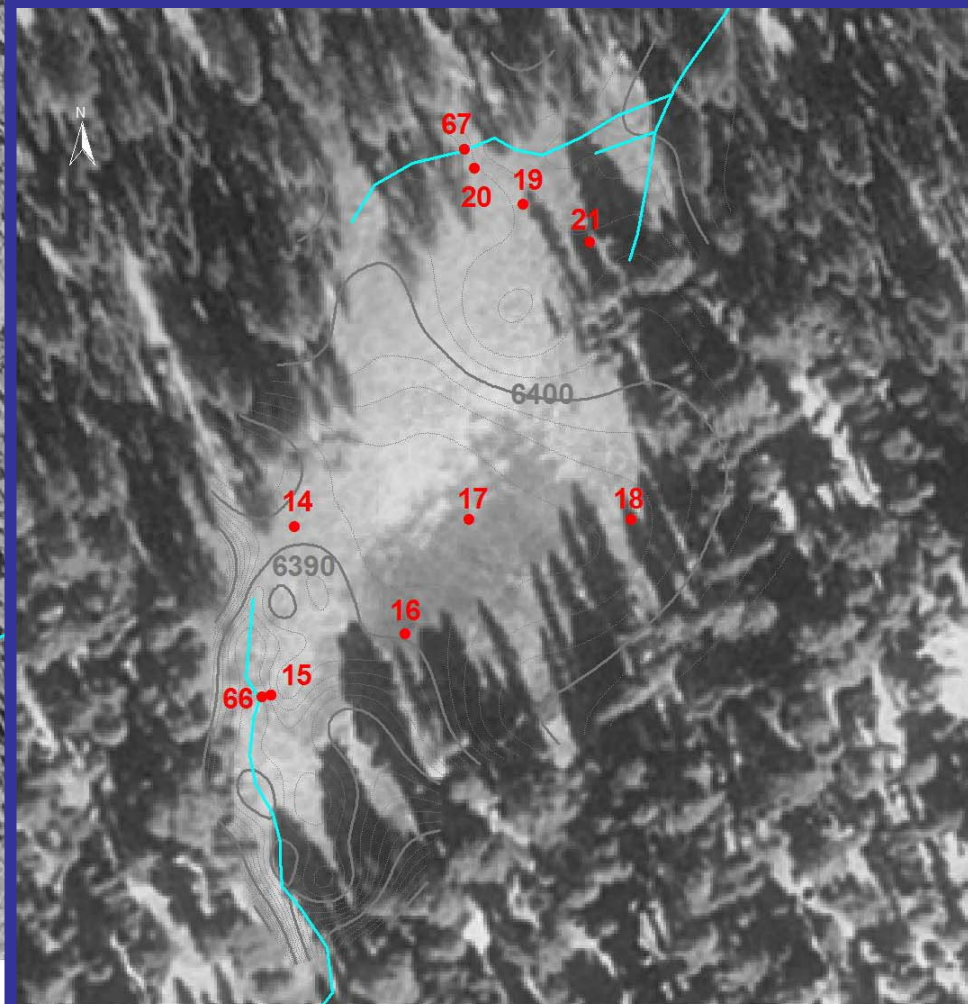




- Wells and staff gauges
- Channelized surface water
- 10 ft contours
- 2 ft contours
- Major log

200 0 200 400 Feet

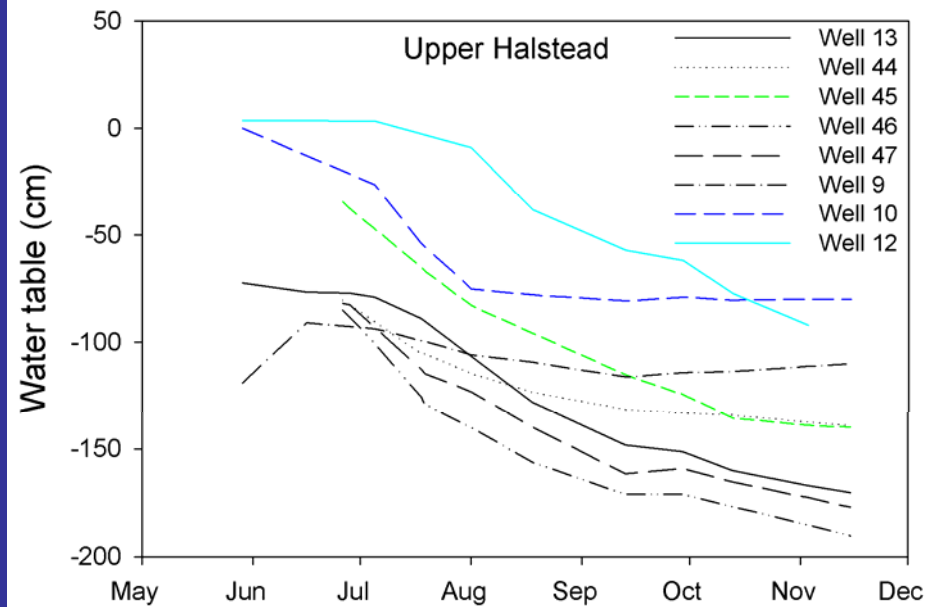
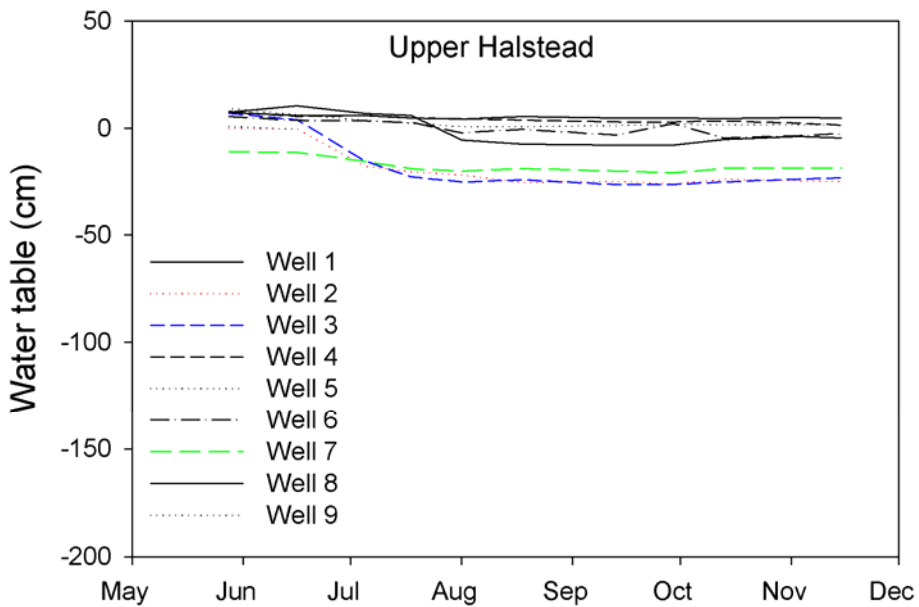
Crescent Meadow



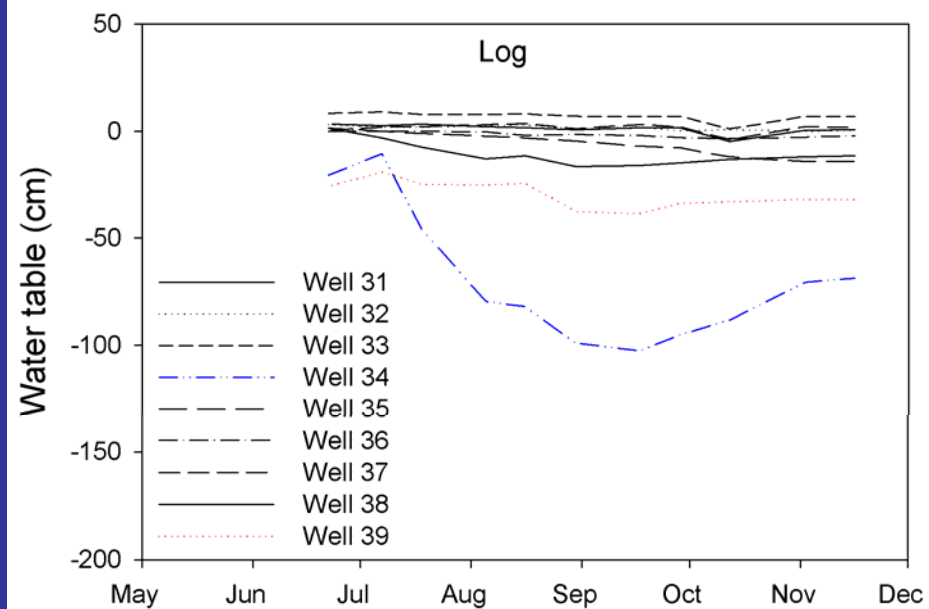
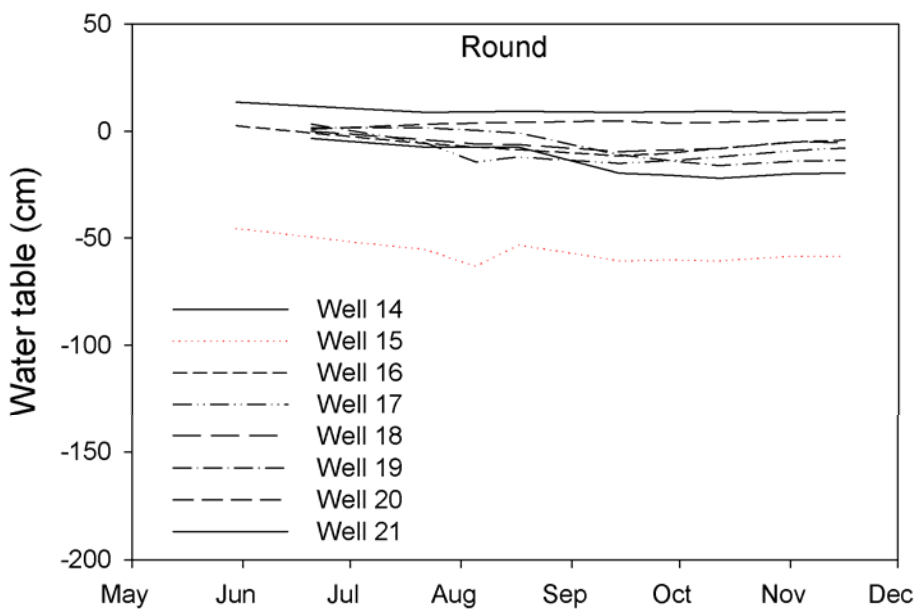
- Wells and staff gauges
- Channelized surface water
- 10 ft contours
- 2 ft contours

100 0 100 200 Feet

Round Meadow



## Reference Meadow Summer Water Table



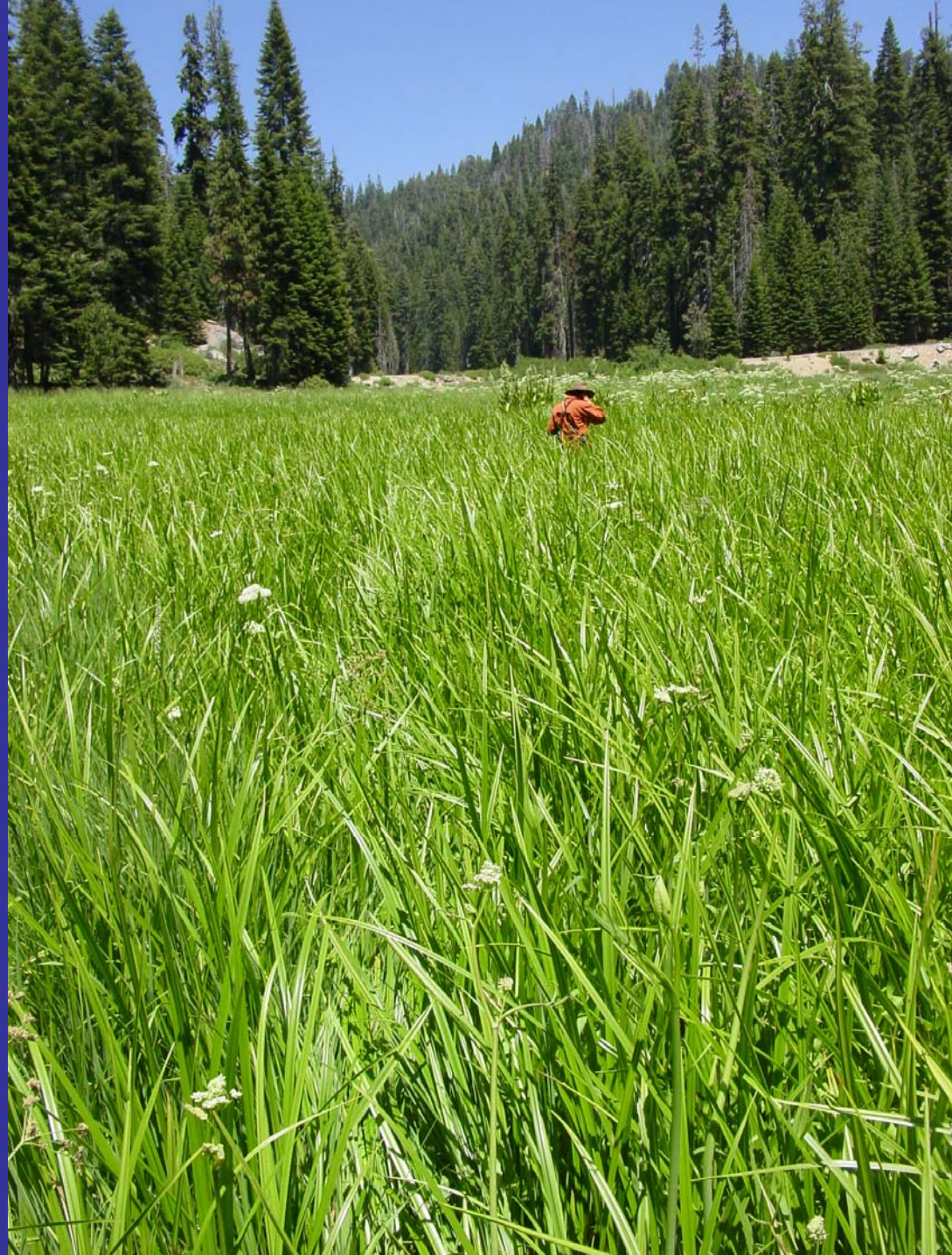


# Dominant native species

*Scirpus microcarpus*

*Oxypolis occidentalis*

*Glyceria elata*





# Vegetation of Disturbed Meadow



*Heracleum, Mertensia, Rumex*

Abundant burrowing mammals create tunnels, soil instability



# Importance of large wood





# Conclusions from Reference Meadow Analysis & Project Goals

1. Sheet flow hydrologic systems - no significant stream channels
2. Meadows level from side to side, restore topography
3. Fill gully completely?
4. Vegetation of highly productive bulrush, and other herbaceous species
5. Large wood important for stabilizing meadow surface



# Restoration was Goal

- Bring back to a former state or condition
- Pre-gully condition and hydrologic functioning
- Used reference meadows to develop restoration concepts

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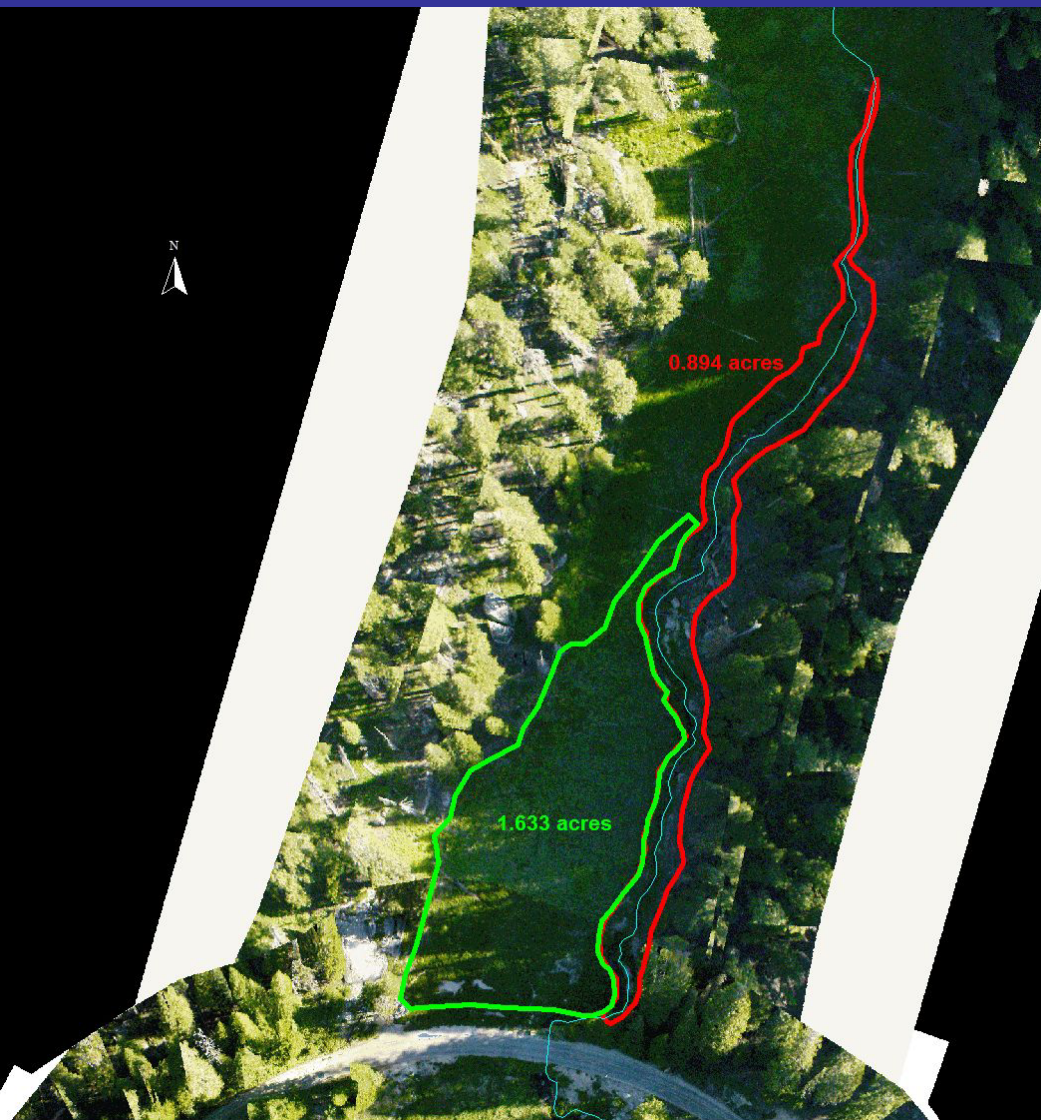
Not use “pond and plug”  
dams, or “stabilization”



# Halstead Site Analysis




- Existing topography - topographic survey
- Determine sediment needs to fill gully
- Water table depths as pre-restoration baseline
- Vegetation composition of impacted areas and reference areas to develop planting plan/vegetation goals





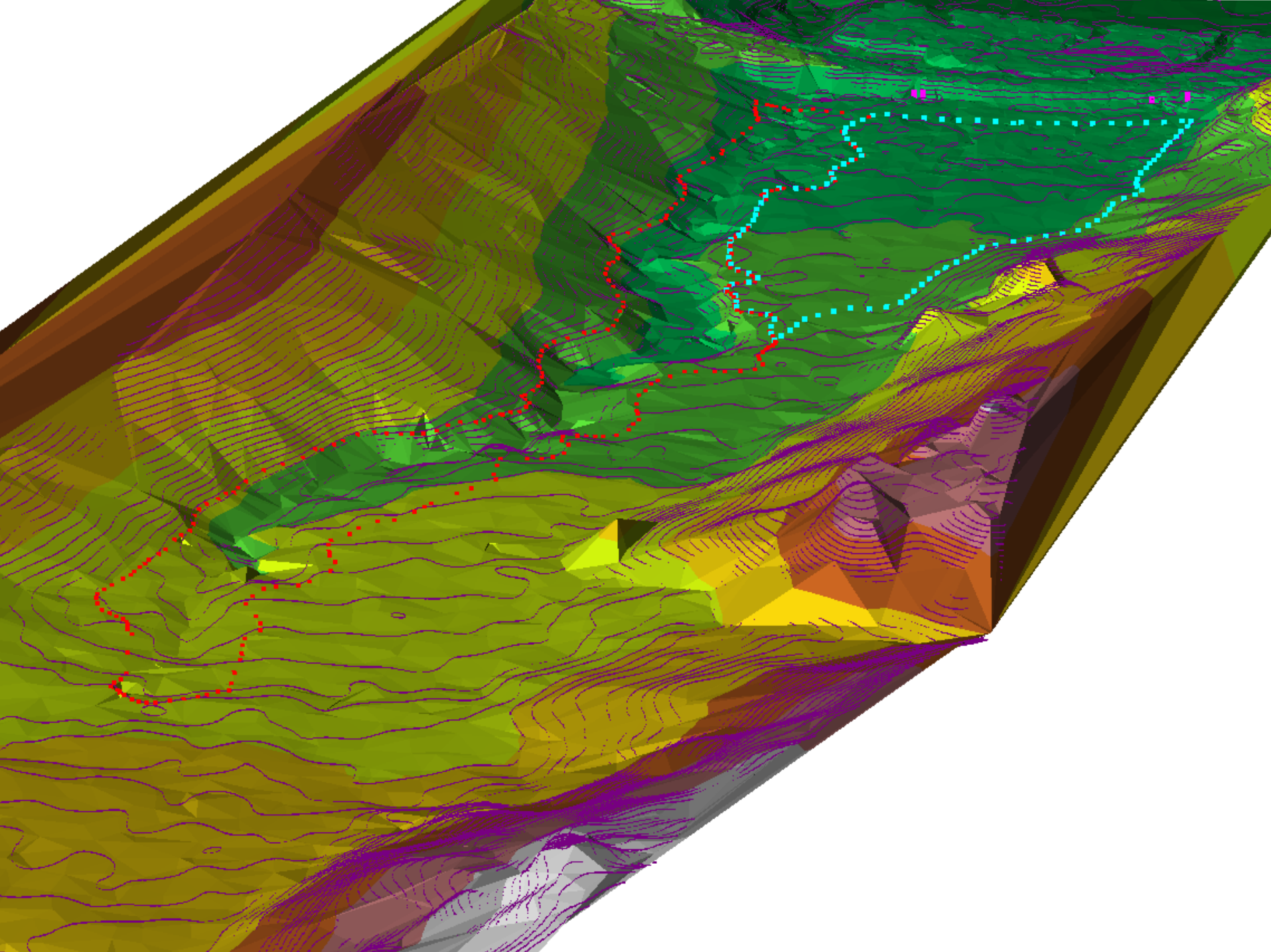
**0.894 acres gully =  
major earthwork  
and planting**

**1.633 acres, drained  
by gully = minor  
earthwork and  
planting**

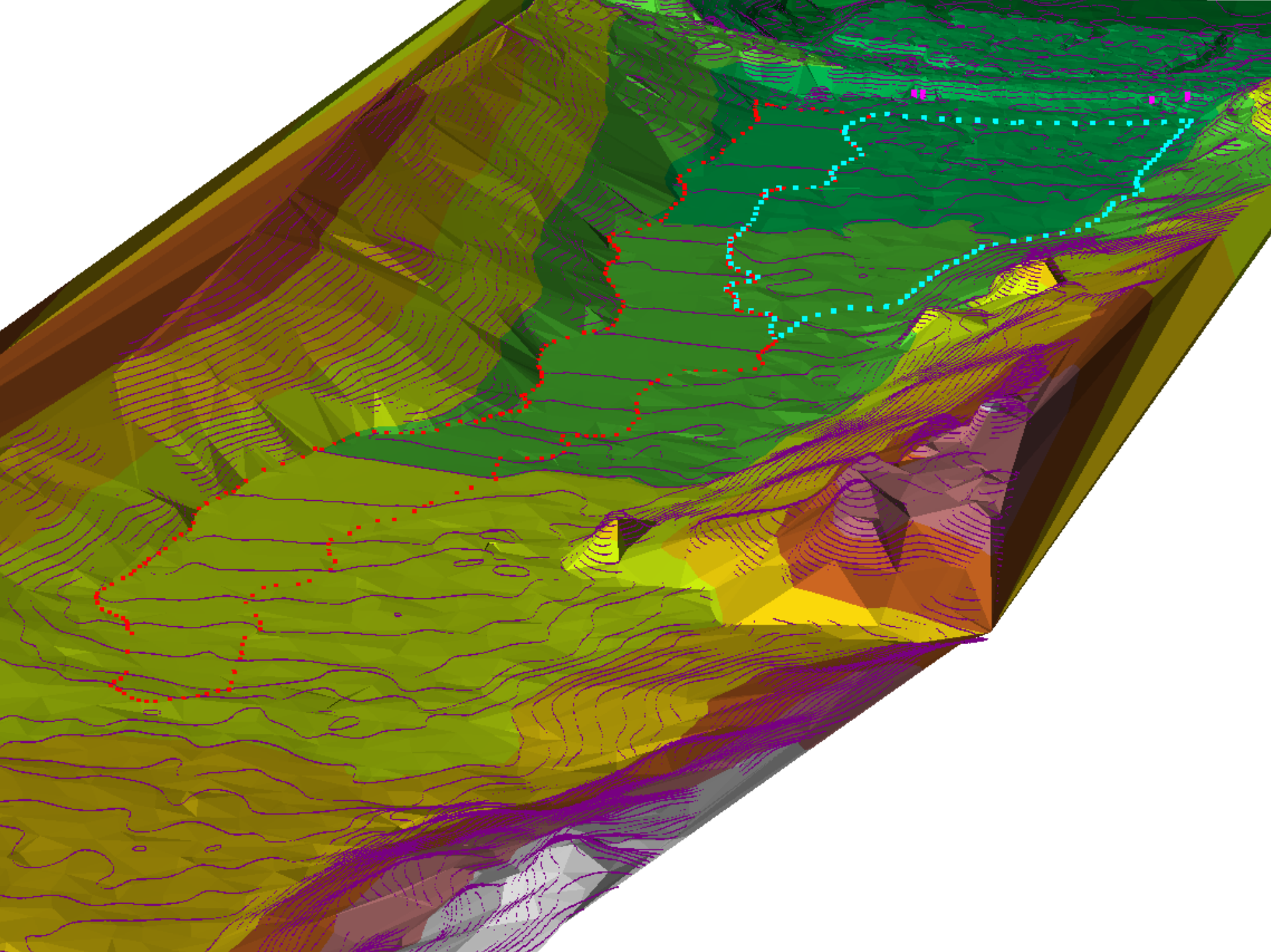
-  Drained meadow
-  Halstead Creek
-  Eroded gully

200 0 200 Feet

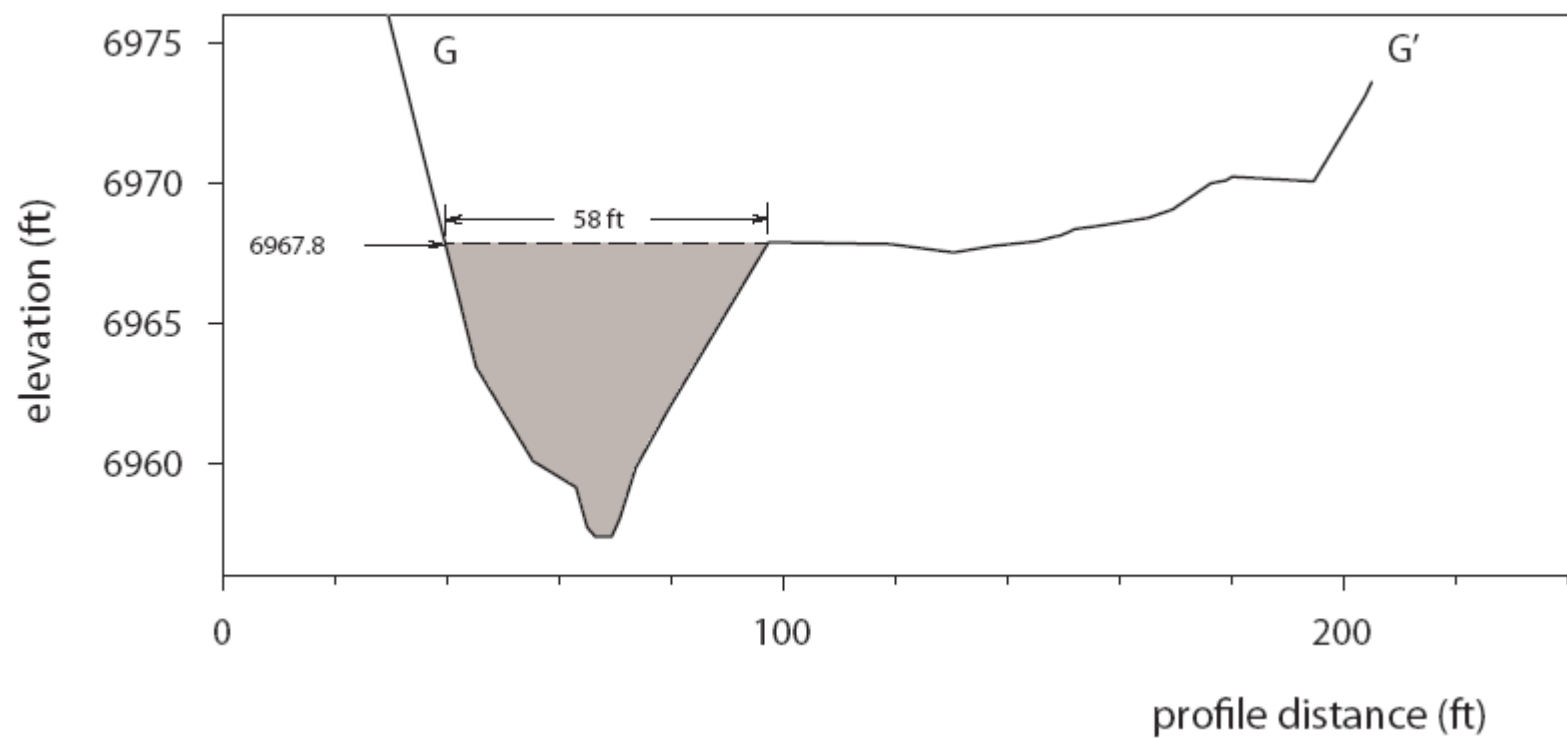
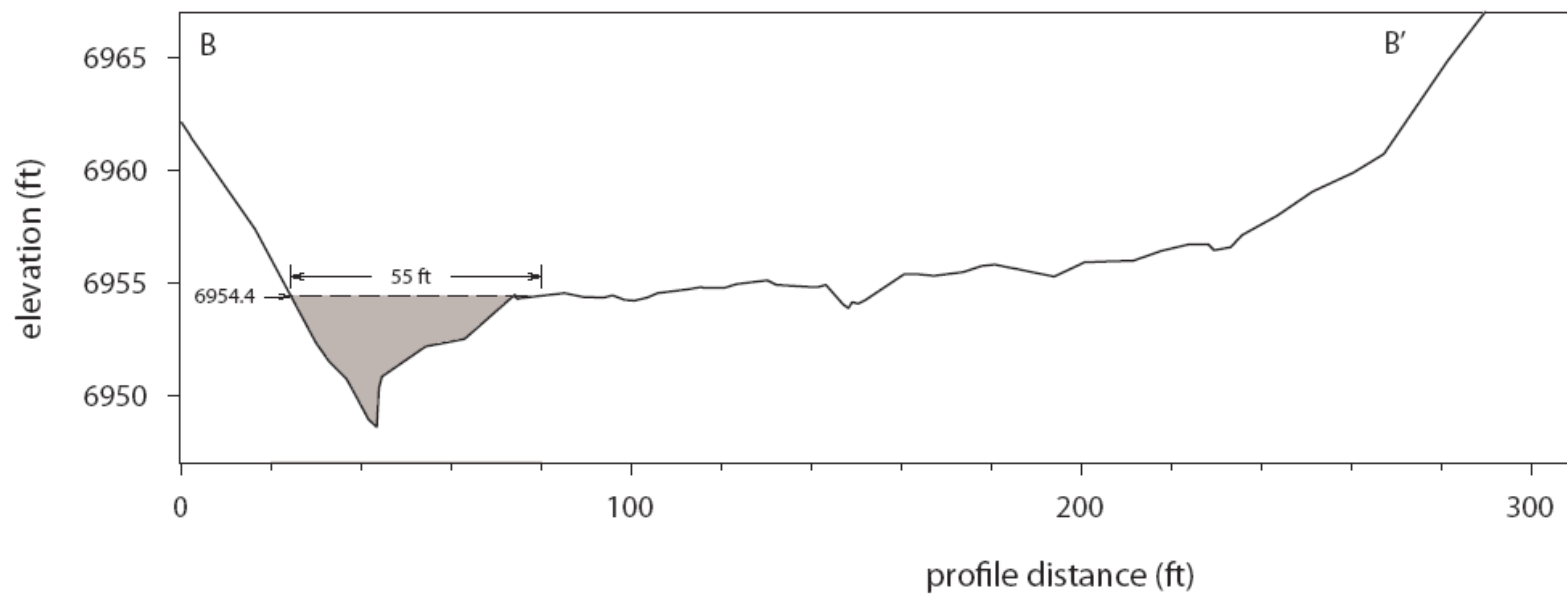




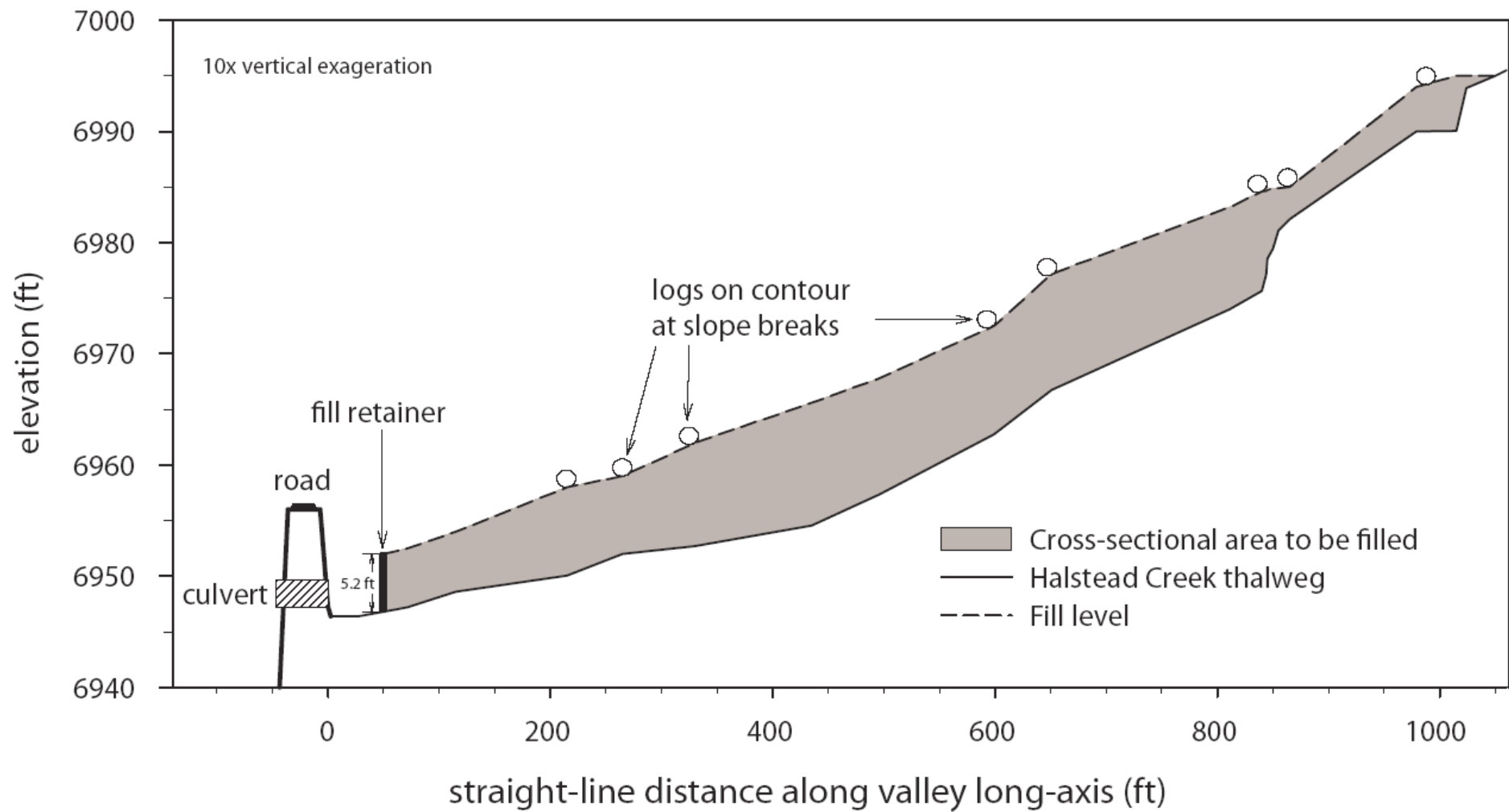














- Sediment needed:  $\sim 8,500 \text{ yd}^3$
- Source?
- Create construction documents for bid and EA, S404 permit
- Solicit bids, conduct tours for contractors, select contractor, produce contract
- Mobilization, construction





























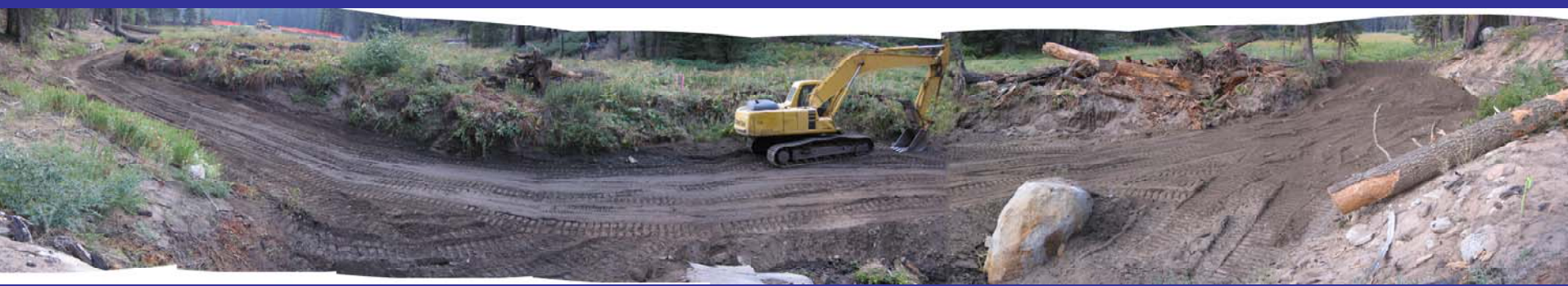
























































































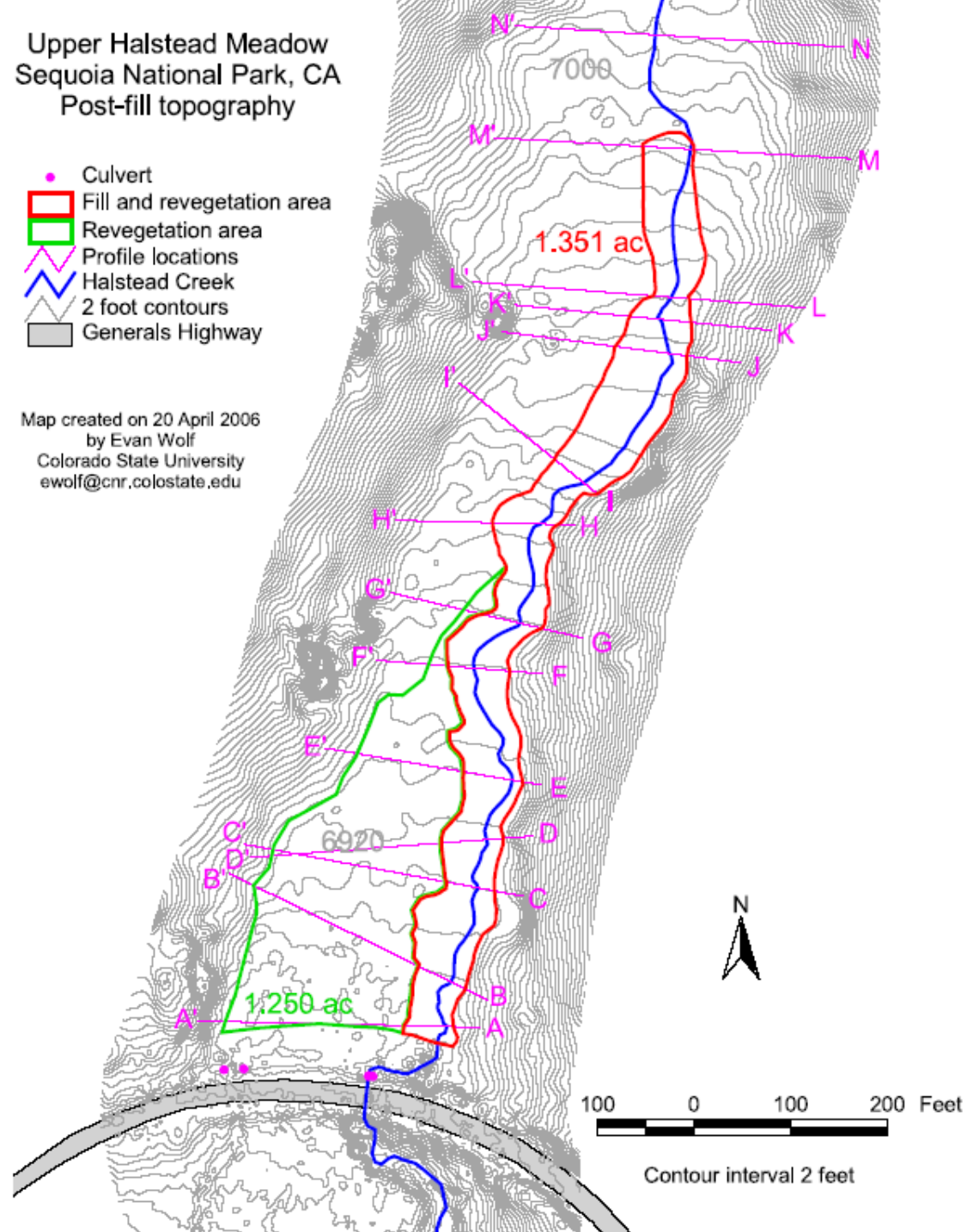


# Post-construction fill volume survey to determine final payment

## Upper Halstead Meadow Sequoia National Park, CA Post-fill topography

- Culvert
- ▭ Fill and revegetation area
- ▭ Revegetation area
- Profile locations
- Halstead Creek
- 2 foot contours
- ▭ Generals Highway

Map created on 20 April 2006  
by Evan Wolf  
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# Plant Needs

Species	Quantity
<i>Glyceria elata</i> (fowl mannagrass)	10,600
<i>Scirpus microcarpus</i> (panicled bulrush)	32,000
Species	Bid Option 1
<i>Oxypolis occidentalis</i> (western cowbane)	10,600

Collect seed, do germination trials, especially with *Oxypolis*, determine timing for germination, growth, transport and planting, 4-15 June 2008



A large, arched hydroponic greenhouse with a white plastic covering and a metal frame. Inside, there are several long white trays filled with small green seedlings. To the right, there is a long bed of green grass. The greenhouse has a high ceiling with various pipes and a fan visible on the right side. The floor is concrete and appears to be wet.

**Contract grown seedlings at  
HYDRA Aquatic in New Mexico**





Watering  
system



Roots fill  
the tube  
and hold  
soil  
together



# Lower Halstead Meadow & Bridge





# Key issues for wetland restoration design/implementation

1. Data collection in reference areas to develop restoration concepts for topography, landforms, hydrologic regime, vegetation, soils (*don't rush – the data are critical*)
2. Careful onsite analysis to determine impacts and required elements of restoration program (*don't rush*)
3. Carefully worded restoration bid package
4. Get the right contractors – bad contractors will ruin your project
5. Use on-site supervisor, communicate with contractors
6. Have conferences daily to discuss issues and get resolution
7. Listen to constructive criticism and naysayers, but be creative because NPS should strive to achieve true restoration